WELCOME TO THE OCTOBER EDITION OF THE 2016 M&R SEMINAR SERIES
BEFORE WE BEGIN

• SAFETY PRECAUTIONS
  – PLEASE FOLLOW EXIT SIGN IN CASE OF EMERGENCY EVALUATION
  – AUTOMATED EXTERNAL DEFIBRILLATOR (AED) LOCATED OUTSIDE

• PLEASE SILENCE CELL PHONES OR SMART PHONES

• QUESTION AND ANSWER SESSION WILL FOLLOW PRESENTATION

• PLEASE FILL EVALUATION FORM

• SEMINAR SLIDES WILL BE POSTED ON MWRD WEBSITE (www.MWRD.org: Home Page ⇒ Reports ⇒ M&R Data and Reports ⇒ M&R Seminar Series ⇒ 2016 Seminar Series)

• STREAM VIDEO WILL BE AVAILABLE ON MWRD WEBSITE (www.MWRD.org: Home Page ⇒ MWRDGC RSS Feeds)
Daniel E. Collins, P.E.

**Current:** Managing Civil Engineer, M&O Department, Metropolitan Water Reclamation District of Greater Chicago (MWRD)

**Experience:** Biosolids manager, EMS coordinator, Biosolids Task Force Leader, MWRD
Led District EMS Certification in 2008
Principal Civil Engineer, Section head of LASMA Biosolids Management
Senior Civil Engineer, Acting Section Head of Solids Management, CWRP
Associate Civil Engineer, CWRP Biosolids Drying Facility Manager
Assistant Civil Engineer, M&O Biosolids Management, MWRD

**Education:** Bachelor of Science in Mechanical Engineering, Purdue University, Indiana

**Professional:** WEF: National Biosolids Partnership Advisory Committee Vice Chair Residuals & Biosolids Committee, Sustainability Sub-Committee
IWEA – President Elect and Biosolids Committee
NACWA – Biosolids Management Committee
Guanglong Tian, Ph.D.

Current: Provisional Supervising Environmental Soil Scientist, M&R Dept, Metropolitan Water Reclamation District of Greater Chicago (MWRD)

Experience: Manage Biosolids Utilization and Soil Science Section, and MWRD’s Fulton County Nutrient Loss Reduction studies
Senior Environmental Soil Scientist and Soil Scientist I, MWRD
Visiting Soil Ecologist (Adjunct Faculty), Institute of Ecology, Univ. of Georgia
Scientist (Section Head)/Associate Scientist/Postdoctoral Fellow International Institute of Tropical Agriculture, Ibadan, Nigeria

Education: Ph.D. in Soil Biology/Soil Fertility, Wageningen Agricultural University, The Netherlands
M.S. in Soil Geography, Chinese Academy of Sciences, China
B.S. in Soil Science/Agrochemistry, Sichuan Agricultural University, China

Professional: Subject Editor of Soil Biology and Biochemistry (2001 - 2007)
Committee of Agricultural Soil CO$_2$ Expert Group of Intergovernmental Panel on Climate Change
USDA Biosolids Committee (W3170)

Award: Recipient of the Soil Science Society of America’s 1999 Young Scholar Award
Biosolids Composting and Class A Biosolids Product Utilization at the Metropolitan Water Reclamation District of Greater Chicago

Dan Collins
Guanglong Tian
MWRDGC – Wastewater

Government Agency Created in 1889 to protect the waters of Lake Michigan

Approximately one-half of the sewage treatment capacity for the state of Illinois

1.5 Billion Gallons of Wastewater per day
The District generates approximately 140,000 DT of biosolids for utilization every year.

Biosolids are processed for at 4 WRPs:

<table>
<thead>
<tr>
<th>Location</th>
<th>Amount Utilized/Year (DT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stickney</td>
<td>110,000</td>
</tr>
<tr>
<td>Calumet</td>
<td>22,500</td>
</tr>
<tr>
<td>John E. Egan</td>
<td>6,500</td>
</tr>
<tr>
<td>Hanover Park</td>
<td>1,000</td>
</tr>
</tbody>
</table>
SOLIDS HANDLING AND PROCESSING SCHEMATIC

1. Rail/Train to Lagoons
   SWRP Only

2. Aging Lagoons

3. Rail/Train to Lagoons
   SWRP Only

4. Aging Lagoons

5. Lagoon Outloading

6. Air Drying

7. Screening/Testing

8. Beneficial Reuse Programs

---

Pipe
- Kirie (52 mgd)
- Egan (30 mgd)
- Northside (333 mgd)
- Stickney (1,200 mgd)
- Calumet (354 mgd)

Truck
- Lemont (3.4 mgd)

---

Hanover Park (12 mgd)
Egan (30 mgd)
<table>
<thead>
<tr>
<th>Trace Metal</th>
<th>Part 503 Allowable</th>
<th>Exceptional Quality</th>
<th>MWRD Biosolids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>75</td>
<td>41</td>
<td>5</td>
</tr>
<tr>
<td>Cadmium</td>
<td>85</td>
<td>39</td>
<td>3</td>
</tr>
<tr>
<td>Copper†</td>
<td>4,300</td>
<td>1,500</td>
<td>380</td>
</tr>
<tr>
<td>Mercury</td>
<td>57</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>Molybdenum †</td>
<td>75</td>
<td>---</td>
<td>10</td>
</tr>
<tr>
<td>Nickel †</td>
<td>420</td>
<td>420</td>
<td>40</td>
</tr>
<tr>
<td>Lead</td>
<td>840</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>Selenium †</td>
<td>100</td>
<td>100</td>
<td>5</td>
</tr>
<tr>
<td>Zinc †</td>
<td>7,500</td>
<td>2,800</td>
<td>725</td>
</tr>
</tbody>
</table>

*Biosolids are Regulated at the Federal Level

† Essential plant nutrient
Recent Changes to IL Regulations
(Public Act 099-0067)

- Passed in July 2015, adopting USEPA Part 503 EQ Standard in Illinois
- States that Exceptional Quality biosolids can “be used on land as a beneficial recyclable material that improves soil tilth, fertility, and stability…”
- And that Exceptional Quality biosolids are “a resource to be recovered…”
- But most importantly, “to encourage and promote the use of Exceptional Quality biosolids in productive and beneficial applications, to the extent allowed by federal law, Exceptional Quality biosolids shall not be subject to regulation as a sludge or other waste…”
- Allows for nearly unrestricted distribution of biosolids.

Metropolitan Water Reclamation District of Greater Chicago
History of Biosolids Use

- Landfills
- NU Earth
- Fulton County Land Reclamation (over 1 million tons used)
- Land Application on Farmland
- Controlled Solids Distribution
There are 7 essential plant nutrient elements. They constitute in total less than 1% of the dry weight of most plants.

**Essential Elements**

- **Major Nutrient**
  - Nitrogen (N)
  - Phosphorous (P)
  - Potassium (K)

- **Minor Nutrient**
  - Calcium (Ca)
  - Magnesium (Mg)
  - Sulfur (S)

- **Micro- Nutrient**
  - Iron (Fe)
  - Manganese (Mn)
  - Boron (B)
  - Chlorine (Cl)
  - Zinc (Zn)
  - Copper (Cu)
  - Molybdenum (Mo)
Current MWRDGC Biosolids Beneficial Reuse Programs

- Fertilizer on farmland (up to 60% of production)
- Substitute for soil on landfill - Final Cover
- Fertilizer and soil amendment in the Chicago metro area (Controlled Solids Distribution/District Utilization)
How and Where are MWRD Class A Biosolids Utilized in the Chicago Metro Area?
20+-year Class A Utilization of Biosolids in Chicagoland

Over 100 users including:

- Golf courses
- School Athletic fields
- Park Districts
- Sport facilities
MWRD Biosolids
Good for Cook County

MWRD biosolids are used for parks, sports fields, golf courses and landscaping throughout Cook County.

A valuable resource recovered by the MWRD’s wastewater treatment process, biosolids are a sustainable and effective alternative to chemical fertilizers. From the scenic riverwalk in downtown Chicago to grassy neighborhood parks, biosolids help make Cook County green.
Biosolids for Turf Maintenance

Coyote Run Golf Course

Why use biosolids?

- Slow release of nutrients
- Reduced use of pesticides/fungicides
- Improved water holding capacity of soil, reducing irrigation needs

Metropolitan Water Reclamation District of Greater Chicago
Biosolids for Putting Green Root zone

At NSCC, Glenview, 10+ types of soil conditioners, including biosolids, were used for constructing a root zone in for a putting green according to USGA specifications.

The turf area consisting of biosolids as the root zone amendment had superior performance at all times compared to the other amendments.

Photo: Courtesy of F. Dan Dinelli
Oak Forest High School – Football Field

Just seeded and applied biosolids

Two months later!

- Save thousands of dollars in fertilizer costs
- Improved soil
- Support green initiatives
Lessons Learned

• Disadvantages:
  – Not a pellet (Particle Size Varies)
  – Process is Land intensive
  – Weather Dependent
  – High Use Periods are early/late in the year.
  – No storage of product
  – Mishandling by end users!
  – Odorous if stockpiled!
District’s Strategic Goals

- Reduce/eliminate odors due to current biosolids drying and handling procedures
- Reduce Transportation Costs
- Create readily available end-use products independent of weather variation
- Reduce operational land requirement (Carbon Footprint)
- Increase adoption of Controlled Solids Distribution program within Cook County
- Ensure financial/environmental sustainability of the program

Annual metrics
- 2017: 70% local utilization – CSD
- 2018: 100% local utilization – CSD
Composting Can Help Meet Strategic Goals

- Produces a Class A material efficiently and consistently
- Reduces odor during solids management operations
- Produces an odor free final product
- Reduces overall operation costs
- Produces value-added/marketable product with a potential revenue stream
- Reduces operational footprint
Product from Biosolids-Woodchips Composting
## Composted Biosolids Function and Utilization

<table>
<thead>
<tr>
<th>Use</th>
<th>Brown Field Restoration</th>
<th>Turf Maintenance</th>
<th>Highway Edge Revegetation</th>
<th>Planting Bed</th>
<th>Raised Garden/Indoor Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer</td>
<td>√</td>
<td>√</td>
<td></td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Soil amendment</td>
<td>√</td>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Mulch</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Growth media</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Disease suppression</td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>

*Metropolitan Water Reclamation District of Greater Chicago*
Spread 1.5-inch composted biosolids and roto-till to 6-inch depth or Composted biosolids spread in flower beds

Mix Composted biosolids:Soil at 1:3 ratio

2-inch composted biosolids for revegetation
Networking of Biosolids/Composted Biosolids Utilization

MWRD

Brownfield stakeholder

Landscaper

Construction

Transportation

Golf course, Park, School

Villages
Composting Temperature Monitoring

- Temperature recorded at 15 minutes interval, downloaded daily
- Part 503 requirement: Temperature @ 55\(^\circ\) C for >15 days & 5 turnings
• Over 65 piles already produced in 2016
• All piles composted met temperature requirements
## Composted Biosolids Quality Test

<table>
<thead>
<tr>
<th>Key Parameter</th>
<th>Target Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability</td>
<td>&lt;2 mg CO$_2$-C/g organic matter/day</td>
</tr>
<tr>
<td>Maturity</td>
<td>&gt;80% seed germination</td>
</tr>
<tr>
<td>Odor degree</td>
<td>&lt;5 on the scale of 1-10</td>
</tr>
<tr>
<td>Soluble salts</td>
<td>&lt; 5 dS/m</td>
</tr>
<tr>
<td>pH</td>
<td>6-8</td>
</tr>
<tr>
<td>Trace metals</td>
<td>EQ limit</td>
</tr>
<tr>
<td>Fecal coliform</td>
<td>&lt;1000 MPN/g</td>
</tr>
</tbody>
</table>

Sampling after 16-week curing
Olfactometer - Composted Biosolids

• Have to “guess” which source has odor even under the highest odor concentration
• Odor generally below detection
Direct Sniffing

- Scale: 1 - 10
- Standard for odor rating

- Centrifuge-dewater biosolids: 10
- Air-dried biosolids: 5
- Sand: 0
Composted Biosolids Odor Evaluation

• Scale: 1 – 10
• Target level: < 5

Odor Rating

Air-dried biosolids
Composted Biosolids Stability Test

- Stable: <2 mg CO$_2$-C/g organic matter/day
Compost Performance Test
Biosolids: A Sustainable Soil Amendment and Fertilizer

Biosolids are a product of wastewater treatment that captures the plant nutrients and carbon needed for healthy soils. Air-dried biosolids look and feel like dark, fine-textured retail stores.

Air-dried biosolids can be used almost anywhere lawn fertilizers are used, such as on turfgrass at golf courses, athletic fields, parks and other recreational areas, and for rested be used as any compost would be, as a soil amendment or conditioner for establishing turfgrass, for mixing into custom topsoil blends, and in planter beds and pots for established compost product actually improves the soil for plants, helping to increase water retention and promote root development. Better soil and healthier plants require less maintenance.

Metropolitan Water Reclamation District of Greater Chicago (MWRD) air-dried biosolids are dried on paved pads to achieve ~60 percent solids content at which point the biosolids are blended and co-composted with woodchips in windrows. At the MWRD, the composted biosolids and air-dried biosolids are generated by following U.S. Environmental most stringent criteria for biosolids.

Biosolids are safe

The MWRD biosolids meet the USEPA’s 40 CFR Part 503 regulations, which are based on comprehensive risk assessments that are protective of human health and the environment, based on scenario of a person coming into contact with biosolids or food grown on land receiving biosolids. These scenarios include children ingesting biosolids, workers in their vegetable gardens.

MWRD has an exemplary biosolids management program. MWRD biosolids go through an extensive testing regimen to ensure each batch is of the highest quality. The MWRD’s athletic fields at both public parks and schools in the Chicago area for more than 30 years.

Latest Regulatory Development

On July 30, 2015, Illinois Governor Bruce Rauner signed legislation (Public Act 99-0998) that amended the Illinois Environmental Protection Act to recognize biosolids as a safe...
Back to the District’s Strategic Planning
Goal – Production of Composted Biosolids

**Objective**
Co-compost biosolids and woodchips to produce a value-added and sellable product.

**Description**
Achieve a higher level of sustainability within the District’s service area.

- IGA with the City of Chicago
  - 2016: 48,000 CY of woodchips Utilized

- New Woodchip and Yard Waste Program Ordinance in 2016
  - Additional Resource Recovery
  - Cost Recovery, Charge a tipping fee to receive feedstock and create a new revenue stream from the sale of composted biosolids.
  - Sustainable Practice of co-composting yardwaste/woodchips with biosolids

**Target Production**
- 2016: 10,000 tons  
- 2017: 50,000 tons  
- 2018: 100,000 tons
Lessons Learned

• Difficult to meet Class A pathogen reduction
  – Inconsistent/Uneven Heating due to poor mixing.
  – Clumps are always present (Pathogen Carriers)
  – Low %TS is too weather dependent
  – Labor Intensive
  – Cross Contamination
  – Slow screening process
Current and Short Term Operations

• Raw Materials
  – Dewatered biosolids
  – Wood Chips – currently from City of Chicago

• Process
  – Blending ratio = 1:3 biosolids to wood chips by volume
  – Monitoring: temp probes with data collection
  – Active Composting – 23 days @ 55° C (5 turns)
  – Curing – 16 weeks
  – Quality control (stability testing)

• Final Product
  – Screening – just before shipping
  – Storage
Proper Equipment

Windrow turner

High Volume Screener
Long Term: Proposed Covered Composting Facility at CALSMA

Specifications
- 3-phase composting system using GORE® covers
  - Phases 1 and 2 – Active Aerated Covered Composting
  - Phase 3 – Cooling/curing (Uncovered)
- Capacity to process 25,000 dry tons of biosolids

Process
- 1:3 biosolids to feedstock mix ratio by volume
- 1 temperature probe per pile
- Necessary equipment includes mixers, loaders, screeners

Final Product
- Testing not required if we adhere to the USEPA approved GORE® process
- Class A EQ composted biosolids
How it works!

Weather Resistant

Oxygen Sensor

Odour/Volatile Substances

Humidity

CO₂

Temperature Profile Probe

GORE® Cover

Anchor

Heat

Germs

Bacteria

Air

Air
Proposed Composting Facility at CALSMA
## Potential Compost Distribution

<table>
<thead>
<tr>
<th>Market</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agronomic</td>
<td>Soil amendment, fertilizer</td>
</tr>
<tr>
<td>Nurseries</td>
<td>Seed starter, container mix</td>
</tr>
<tr>
<td>Landscaping</td>
<td>Topsoil blending, mulch, soil amendment</td>
</tr>
<tr>
<td>Turf</td>
<td>Seed starter, topsoil blending</td>
</tr>
<tr>
<td>Forestry</td>
<td>Mulch, soil amendment</td>
</tr>
<tr>
<td>Land reclamation</td>
<td>Mulch, soil amendment</td>
</tr>
<tr>
<td>Residential</td>
<td>Seed starter, topsoil blending, mulch, soil amendment</td>
</tr>
<tr>
<td>Commercial</td>
<td>Landscape Suppliers: Retail stores (e.g., Home Depot)</td>
</tr>
</tbody>
</table>
Community Gardens

- ChicaGRO Intergenerational growing project. Turning vacant South Chicago neighborhood lots into backyard community gardens. (72 Gardens)
- Hanover Park Tree Farm & MWRD Tree Sapling Program
- Landscaping Beds and tree planting
- Park Districts
The Village of Midlothian

Applying compost for planting grass at a vacant lot in 2016.

A few weeks later...
To Use Biosolids/Composted Biosolids

Call in Advance
Dominic Brose 708-588-3134; brosed@mwrdd.org
Wale Oladeji 708-588-4246; oladejio@mwrdd.org

MWRD Technical Support
• Soil scientist will assist in filling User Information Sheet
• MWRD soil scientist can provide technical assistance in the planning of the use of biosolids/composted biosolids
Thankyou and Questions?